

REMARKS

Reconsideration and allowance of this application are respectfully requested in view of the amendments above and the remarks below.

Election/Restriction

In the Office Action, claims 20, 23, and 25 are indicated as being withdrawn from consideration allegedly due to being drawn to a non-elected species. However, claims 20, 23, and 25 are dependent from claim 17. Thus, claim 17 is a generic or linking claim and covers the species described in claims 20, 23, and 25. Withdrawal of this objection is respectfully requested.

Objection to the Specification

In the Office Action, the specification was objected to under 35 U.S.C. §112, first paragraph, as being allegedly not clear, concise and exact. Applicant respectfully, but most strenuously, traverses this rejection for the reasons below.

By this amendment, various paragraphs of the specification have been amended as suggested by the Examiner to correct various typographical errors.

In addition, upon recently comparing the present application to the related PCT patent application (WO 02/087827) on which the present application was based and from which it claims priority, it was noted that several portion of the present application did not correspond fully to applicant's earlier related PCT patent application (WO 02/087827). Accordingly, the specification has been amended to incorporate several paragraphs found in the related PCT patent application (WO 02/087827) which was incorporated by reference in the pending application (see, paragraph [0002]), and the omitted text can be found on pages 20, 21, and page 24 of the PCT patent application. A copy of WO 02/087827 is enclosed herewith. Accordingly, the addition of new matter has been carefully avoided.

Withdrawal of the objection to the specification is respectfully requested.

Claim Objection

In the Office Action, claim 26 was objected to because the occurrence of "expect" in line 6, should be changed to "except." By this amendment, claim 26 has been amended as suggested by the Examiner. Withdrawal of this claim objection is respectfully requested.

35 U.S.C. §112 Rejections

In the Office Action, claims 30 and 31 were rejected under 35 U.S.C. §112, as allegedly failing to comply with the enablement requirement. In reference to claim 30, it is allegedly not clearly disclosed in the specification how the pressure is increased or at what point the pressure is increased and it is allegedly unclear in the claim whether the increase of pressure is supposed to interrupt the flow to the nozzle or if the actuation valve is supposed to once actuated. In reference to claim 31, it is allegedly not clearly disclosed in the specification what valve means is intended to cause the increased proportion of fluid to flow from the pressurizing means to the point. Applicant respectfully, but most strenuously, traverses this rejection for the reasons below.

With regard to claim 30, paragraph [0083] along with reference to FIG. 1, describes pump 25 as usually being provided with plungers powered by pneumatics, etc, which allow the pump pressure to be rapidly varied. This allows momentarily increasing the pressure. Increasing the pressure from pump 25 increases the pressure along conduits 1, 2, and 11 to point/junction 14. Thus, with the pressure at point 14 temporarily higher than that in the vessel 19, abrasive/water flow from the vessel 19 is interrupted for long enough for valve 27 to be closeable while clean water is flowing therethrough. In paragraph [0084], line 8 onwards, a corresponding arrangement is described for the flow circuit illustrated in FIG. 2. The pressure is again increased at the pump 25. Although point/junction 14 is not referred to explicitly, the creation of backflow up conduit 18 into vessel 19 indicates that a pressure rise at point 14 occurs here, too. In addition, claim 30 has been amended to specify that the increase in pressure is to interrupt flow from the storage vessel. The addition of new matter has been carefully avoided.

With reference to claim 31, the valve means to cause an increased flow from the pressuring means to the point is valve 5. As described in paragraph [0074], for the circuit shown in Figure 1, when valve 5 is open roughly ninety percent of the water flow from the pump 25 flows along conduits 4, 7, and 11 to junction 14 and thence to nozzle 16. About ten percent flows along conduit 4 but diverts through buffer volume 24 to vessel 19, displacing abrasive and water therefrom to junction 14 and nozzle 16. When valve 5 is closed as described in paragraph [0076], the flow necessarily proceeds directly along conduits 1, 2, and 11 to point 14.

Withdrawal of these §112 rejections is respectfully requested.

35 U.S.C. §103(a) Rejections

In the Office Action, claims 17-19, 21, 24 and 29 were rejected under U.S.C. §103(a) as allegedly being unpatentable over Hehr et al. (U.S. Patent No. 3,704,553) in view of Goodwin et al. (U.S. Patent No. 3,419,220). Applicant respectfully traverses this rejection for the following reasons.

Briefly summarized, one aspect of applicant's invention is directed to a valve for the control of a flow of abrasive particles suspended in a pressurised carrier fluid such as an aqueous carrier liquid for cutting materials such as metals, ceramics, polymers and composite materials. As shown in FIG. 4 with the valve open, fluid enters through an inlet connection 80, and passes through a tube 78, and a pair of valve seats 75 and 74, to an outlet connection 81. Apertures are provided in each valve seat 74 and 75 which are aligned in an open position of the valve, allowing fluid to pass therethrough. To shut off the fluid flow, a first valve seat 75 is slid over a second valve seat 74 to a position in which the aperture through the first seat 75 is sealed off by a face of the second seat 74. A spring 77, acting on a carrier 76 for the first seat 75, loads the seats 74 and 75 together. When the fluid in the inlet connection 80 is pressurized, the major load on the seats 74 and 75 can be due to fluid pressure acting on the upper end of the tube 78.

With reference to Hehr et al., Hehr et al. disclose a gate valve interposed in the delivery line between a spray nozzle and a source of air under pressure. The valve includes a valve body 46 provided with an axial threaded bore throughout its length. One end of the threaded bore of the valve body is connected to spray nozzle 28 having external threads and the other end of threaded bore of the valve body is connected to a externally threaded hose collar 58. Interposed between the inner end of the hose collar 58 and the valve slide 50 is a resilient annular gasket 62 of rubber or other suitable material, and a metal washer 64. The washer is disposed adjacent the valve slide, with the gasket interposed between it and the adjacent end of the hose coupling. The nozzle and hose coupling are threaded into the threaded bore of the valve body sufficiently to bring the inner end of the nozzle and the washer into sliding engagement with the opposite surfaces of the valve slide. This sliding contact serves to restrict the passage of air under pressure radially outward between the slide and the nozzle and washer. The adjusted position of the nozzle and hose collar in sliding engagement with the slide may be releasably secured with set screws 66 and 68. The valve slide is provided with an aperture 52. In one position of adjustment of the slide the aperture registers with the threaded bore (FIG. 2). In another position of adjustment of the slide the aperture is displaced from the bore and the slide intercepts and closes the bore.

As described above in Hehr et al., it is the threaded coupling of the nozzle and hose collar to sufficiently to bring the inner end of the nozzle and the washer into sliding engagement with the opposite surfaces of the valve slide which restricts the passage of air under pressure radially outward between the slide and the nozzle and washer, and not the pressure of the fluid that urges the valve slide into the inner end (28') of the nozzle.

With reference to Goodwin et al., Goodwin et al. disclose a nozzle for abrasive laden slurry and was applied as disclosing the nozzle having a plurality of sections and each section made out of different grade of material. Examples of materials listed in Goodwin et al. include diamond, ceramic materials, boron carbide and tungsten carbide.

By this amendment, claim 17 has been amended to further distinguish applicant's invention from the applied references. In particular, claim 17 has been amended to recite a valve adapted to control a flow of abrasive particles suspended in a pressurized carrier "liquid." Claim 17 also recites that "said valve seat means being urged sealingly together by the pressure of the carrier liquid exerted on one valve seat means." In addition, claim 17 recites that "each said valve seat means comprising a material with a hardness, as measured on the Mohs scale, of at least 9."

First, Hehr et al. disclose (column 2, lines 14-19) that a container 10 is supplied with compressed air along lines 16, 18, 20, 22, and 24 and sand is added through port 26 (column 2, lines 20-24). Substituting a liquid as taught in Goodwin et al. for the air in container 10 of Hehr et al. would render the spraying apparatus of Hehr et al. inoperable for its intended use. In particular, the physics of a liquid prevent it from being suitably compressed and stored in a container as compared to a gas such as air. Thus, Hehr et al. fail to disclose, teach or suggest a "valve adapted to control a flow of abrasive particles suspended in a pressurized carrier fluid" as recited in amended claim 17.

Second, as explained above, in Hehr et al. the valve body, the nozzle, the hose connectors, the valve slide, the gasket and the washer are threadably connected together to seal the components from leakage of air. This sealable connection is irrespective of the size of the internal diameter of the connecting tube and the pressure of the fluid. Accordingly, Hehr et al. fail to disclose, teach or suggest a "valve seat means being urged sealingly together by the pressure of the carrier liquid exerted on one valve seat means" as recited in amended claim 17.

Third, Goodwin et al. disclose one configuration of a nozzle formed from different grades of tungsten carbide. See, Goodwin et al. at column 1, line 59 to column 2, line 9, and column 2, line 63 to column 3, line 4. Tungsten carbides can include a hardness of less than 9 on the Mohs scale. Goodwin et al. further describe boron carbide (9 on the Mohs scale) and diamond (10 on the Mohs scale) being suitable for use in the exit section of the nozzle. See, Goodwin et al. at

column 3, lines 5-10. Ceramic materials have a hardness of about 5 or more. Accordingly, Goodwin et al. fail to disclose, teach or suggest two or more of the portions of the nozzle formed from a material having a hardness of at least 9 on the Mohs scale. Moreover, the specific examples provided in Goodwin et al. teach away from such a configuration. Thus, there is no teaching or suggestion in the combination of Hehr et al. and Goodwin et al. for "each" of said valve seat means "comprising a material with a hardness, as measured on the Mohs scale, of at least 9" as recited in amended independent claim 17.

For the reasons above, amended independent claim 17 is patentable over the combination of Hehr et al. and Goodwin et al. Dependent claims 18-19, 21, 24 and 29 are believed allowable for the same reasons noted above in connection with amended independent claim 17 from which they directly or ultimately depend, as well as for their own additional features.

In the Office Action, claims 17 and 22 were rejected under U.S.C. §103(a) as being allegedly unpatentable over Hehr et al. in view of Kyoto-shi (EP 0884509 A1). Applicant respectfully traverses this rejection for the following reasons.

Kyoto-shi was applied as disclosing a disc valve comprising two valve bodies which slide with each other, wherein at least one of the valve bodies is made of ceramics, and the surface of the valve body is coated with a diamond-like hard carbon film. As explained above, although diamond has a Mohs hardness of 10, ceramic material have a range of Mohs hardness, for example from hardness of about 5 or more. Thus, there is no disclosure in Kyoto-shi that two or more of the sections of the nozzle be fabricated from a material that have a hardness of at least 9 on the Mohs scale.

Accordingly and for the reasons explained above regarding the combination of Hehr et al. and Goodwin et al., the combination of Hehr et al. and Kyoto-shi fails to disclose, teach or suggest applicant's invention as recited in amended claim 17 for a valve adapted to control a flow of abrasive particles suspended in a pressurized carrier "liquid" which includes "said valve seat means being urged sealingly together by the pressure of the carrier liquid exerted on one valve seat

"means" and wherein "each said valve seat means comprising a material with a hardness, as measured on the Mohs scale, of at least 9."

For the reasons above, amended independent claim 17 is patentable over the combination of Hehr et al. and Kyoto-shi. Dependent claim 22 is believed allowable for the same reasons noted above in connection with amended independent claim 17 from which it directly depends, as well as for its own additional features.

In the Office Action, claims 26-28 were rejected under U.S.C. §103(a) as being allegedly unpatentable over Hehr et al. in view of Goodwin et al. and Shipman (U.S. Patent No. 4,569,161). Applicant respectfully traverses this rejection for the following reasons.

Shipman was applied as disclosing a pneumatic powder metering device for abrasive jet machining. Without acquiescing to the characterization of Shipman, Shipman fails to provide the features lacking in the combination Hehr et al. in view of Goodwin et al. as explained above.

Accordingly and for the reasons explained above regarding the combination of Hehr et al. and Goodwin et al., the combination of Hehr et al., Goodwin et al. and Shipman fails to disclose, teach or suggest applicant's invention as recited in amended independent claim 17 (from which claims 26-28 depend) for a valve adapted to control a flow of abrasive particles suspended in a pressurized carrier "liquid" which includes "said valve seat means being urged sealingly together by the pressure of the carrier liquid exerted on one valve seat means" and wherein "each said valve seat means comprising a material with a hardness, as measured on the Mohs scale, of at least 9."

For the reasons above, dependent claims 28-28 are believed allowable for the same reasons noted above in connection with amended independent claim 17 from which they directly or ultimately depend, as well as for their own additional features.

CONCLUSION

It is believed that the application is in condition for allowance, and such action is respectfully requested.

If a telephone conference would be of assistance in advancing the prosecution of the subject application, applicant's undersigned attorney invites the Examiner to telephone him at the number provided.

Respectfully submitted,



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